Space Weather Technical Forecast

Issued on Saturday, 10 September 2022 at 01:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence through the first half of the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low over the past 24 hours, with X-ray activity at GOES16 showing occasional low-magnitude C-class flares. The largest of these flares was a C2.1 appeared to emanate from AR3098 at 08/1711UTC. There are currently five numbered and three un-numbered regions on the visible disc. AR3096 (Dsi/Beta) and AR3098 (Cro/Beta), both located in the northeast quadrant, seem most likely to produce any flares on present classifications. All other groups are small and magnetically simple, with the most recent new group showing some minor spot emergence in a plage region near the southeastern limb.

Coronagraph imagery appeared to show a faint, slow, fairly wide possible CME from off the northwest of the solar disc. However, there is no obvious Earth sided source so this is uncertain and low confidence. Modelling is still being assessed for any possible Earth directed component, although no significant impacts are expected. There is no evidence of any other Earth-directed Coronal Mass Ejections (CMEs).

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, was indicative of a very slowly waning coronal hole HSS from CH20/+.

The solar wind speed showed an erratic but gradual decreasing trend from Elevated to Slightly Elevated levels, falling from values near 530km/s to 410km/s. The solar wind density for the same period was near-average in single figures ppcc, while the IMF stayed within background at 7nT. The north-south component of the IMF was more noteworthy, ranging between +5 and -7nT, with alternating spells of +/-Bz. The phi angle was mainly away from the Sun (positive). Geomagnetic activity was mostly Unsettled to Active during the first half of the UTC day, before becoming largely Quiet.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, was at Background levels, with a very slight enhancement (below even 1pfu at 10MeV).

The high energy electron flux (greater than 2 MeV) was at High levels, with a peak of 1.18e4 pfu at 09/1555UTC. The 24-hour integrated electron fluence remained above the Active (1e8 integrated pfu) threshold but now on a steady falling trend, with 3.85e8 integrated pfu observed at 10/000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is Expected to be largely Low, with a daily very Slight Chance of becoming Moderate with isolated M-class flares, most likely from AR3098 or perhaps AR3096.

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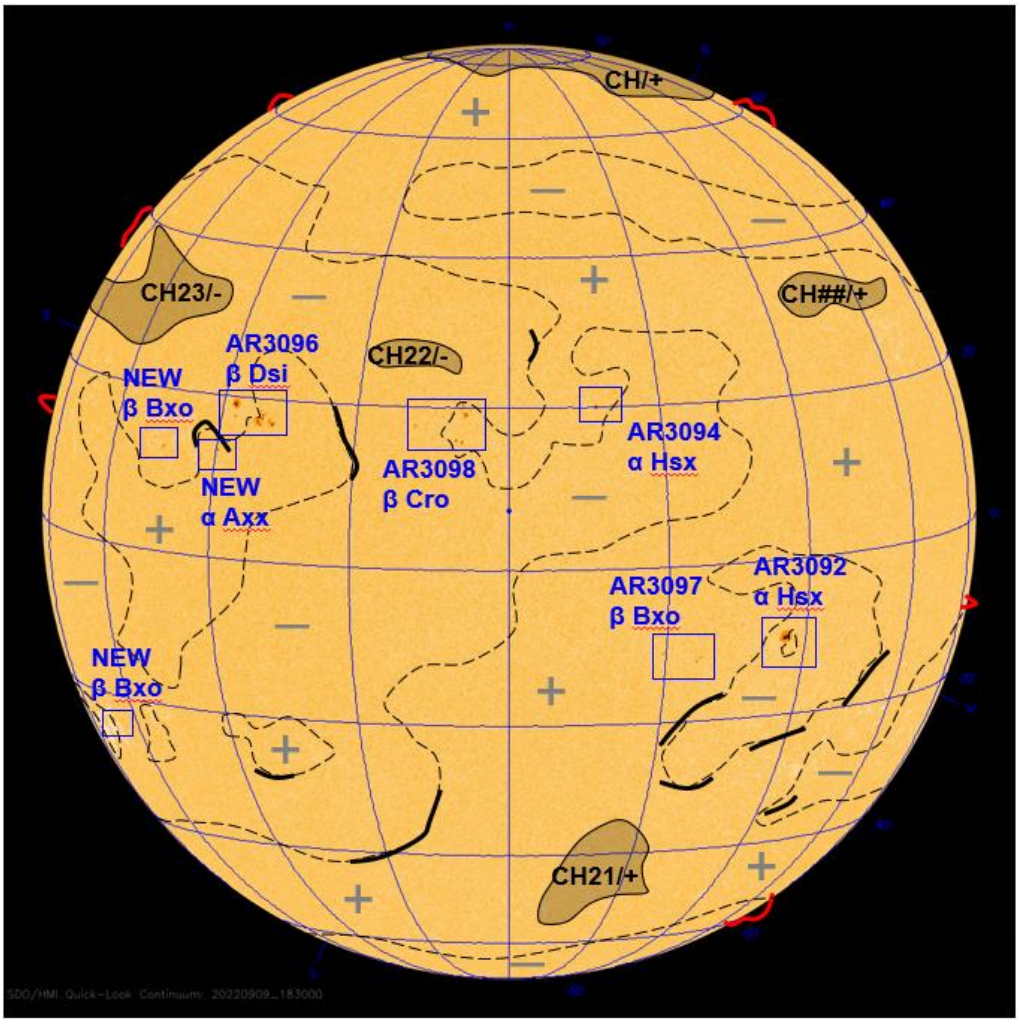
Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast. Residual influence at first from CH20/+ should continue to reduce through day 1 (10th), with solar winds expected to be slightly elevated to background for the forecast period. By the end of day 4 (13th) the small CH22/- could begin to enhance solar winds a little but this is low confidence. Geomagnetic activity is expected to be Quiet to Unsettled (Kp 3) at first, probably trending predominantly Quiet (Kp 0 to 2).

Energetic Particles / Solar Radiation: High energy protons (greater than 10 MeV) are expected to remain below S1/Minor radiation storm levels.

The high energy (greater than 2 MeV) electron flux is currently at High levels and although a downward trend is expected, is likely to continue to reach High levels on the diurnal peak for much of the period. The corresponding 24-hour fluence is expected to see a gradual fall through the period from Active to below Active levels, probably crossing the threshold on day 3 (12th).

Figure 1. Solar Analysis Valid 09/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No Earth directed CMEs currently feature in this forecast period.

Residual influence at first from CH20/+ should continue to reduce through day 1 (10th), with solar winds expected to be slightly elevated to background for the forecast period. By the end of day 4 (13th) the small CH22/- could begin to enhance solar winds a little but this is low confidence. This coronal hole is now the lead fragment of a former much stronger feature on the last rotation, the main body of which is now a weak, diffuse region not currently being analysed as a residual coronal hole.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 3) at first, probably trending predominantly Quiet (Kp 0 to 2).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None currently expected.

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Radio Blackouts - X-Ray Flares:

There are currently five numbered and three un-numbered regions on the visible disc. AR3096 (Dsi/Beta) and AR3098 (Cro/Beta), both located in the northeast quadrant, seem most likely to produce any flares on present classifications. All other groups are small and magnetically simple, with the most recent new group showing some minor spot emergence in a plage region near the southeastern limb.

Ex-3088 is due to return around southeast limb in the second half of the period, which may require a re-assessment of flares probabilities for days 3 and 4 if it retains significant spots/complexity. However, meantime solar activity is expected to be Low with further occasional C-class flaring, and a 5% risk of isolated M-class activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) remains near Background values, with a very slight enhancement evident (below even 1pfu at 10MeV). The source of this slight increase may be tied to the rearward-directed western solar hemisphere CME of 08 September, with a relatively soft onset and rise seen. Repeats of such activity are not considered likely, and little change is expected given the lack of complex regions in potentially geoeffective locations.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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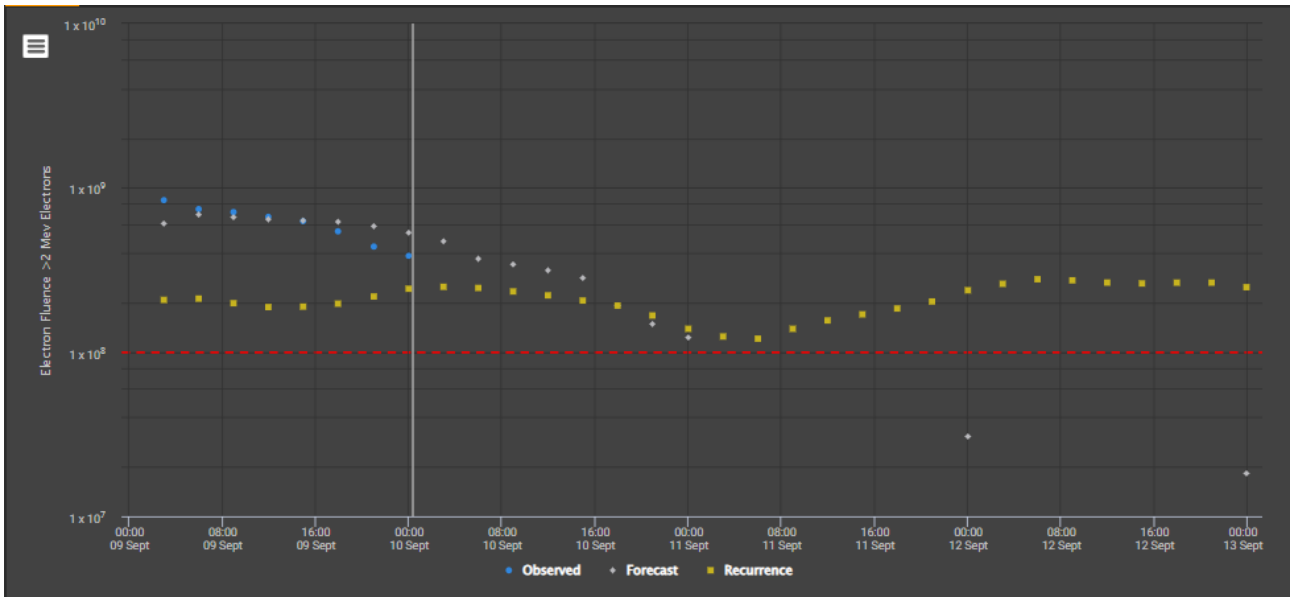
High Energy Electrons Event (≥ 2MeV):

High energy electrons have shown a significant response over recent days to the long-lasting high speed stream from coronal hole 20, but an overall downward trend is now evident. Fluence levels are expected to see a gradual fall through the period from Active to below Active levels, probably crossing the threshold on day 3 (12th). REFM is considered to give reasonable guidance for the overall trend through the period, although perhaps dropping levels too fast.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	80	50	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	10	5	1	1

Figure 2: MOSWOC REFM



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